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USSR Report

ENGINEERING AND EQUIPMENT

No. 66



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26 March 1980

USSR REPORT

ENGINEERING AND EQUIPMENT

No. 66

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USSR

UDC 621.039.562

GAS-SYSTEM REACTOR CONTROL EXPERIMENTS

Moscow ATOMNAYA ENERGIYA in Russian Vol 47 No 5, 1979 pp 334-335 manuscript received 23 Nov 77; after editing 9 Jan 79

YEMEL'YANOV, I. YA., FILIPCHUK, YE. V., POTAPENKO, P. T., FEDULOV, V. V., POTAPENKO, G. T. and SIVOKON', V. P.

[Abstract] The use of gaseous neutron absorbers for reactor control serves to solve the highly important technical problem of the optimal control of energy distribution over the volume of the fuel core. In this connection, the possibilities of controlling the axial neutron flux of the reactor and using the gas system to regulate integral power were investigated through experiments on an IRT-2000 reactor. The control unit was represented by a single assembly of three identical stacked aluminum cylinders containing the gas (^3He) under a pressure of $(0.01-2.0) \cdot 10^5$ Pa. The thermal neutron flux over the height of the fuel core was measured with the aid of the KTV triaxial fission chamber. The effectiveness of each cylinder was measured as a function of its gas pressure, and the deformation of the neutron flux over the height of the fuel core was measured as a function of various combinations of gas pressures in the individual cylinders. The conducted experiments showed that in the presence of below-atmospheric pressures of the absorbing gas the available equipment is adequate for implementing a sufficiently simple and reliable reactor control system. Figures 3; references 4 Russian.

[10-1386]

USSR

UDC 621.316.729

AN AUTOMATIC SYNCHRONIZER WITH CONSTANT LEAD TIME

Moscow ENERGETIK in Russian No 12, Dec 79 pp 23-25

PANFILOV, N. I., PISHCHUGIN, V. G., engineers, SIROTINSKIY, YE. L., candidate of technical sciences, and SOKOVTSSEV, V. I., engineer

[Abstract] The article describes the SA automatic synchronizer developed in the Department of Automation and Relay Protection of Power Systems at Moscow Power Engineering Institute. The synchronizer uses linear conversion of the angle between the power grid and generator voltage vectors to constant voltage, and also the first and second time derivatives of this angle. Synchronizer action is inhibited with respect to the limiting angle with consideration of acceleration and time of actuation of the cutoff. The main components of the synchronizer are: a functional (measurement) converter; a lead time module that contains two differentiating amplifiers, an adder and a comparator; the unit for inhibition with respect to limiting angle, that consists of an adder and a comparator; a unit for inhibition with respect to voltage difference; a module for interlock from transient processes; a logic (output) unit; a frequency-tuning unit; and a power supply. A block diagram of the synchronizer is given, and its operation is explained. Lead time is 0.1-1.0 s, and the limiting lead angle is 120 el. deg. The output relays can switch up to 220 V at 2 A. The limiting difference in amplitudes of input voltages is 15 V. Figures 2.

[6-6610]

USSR

UDC 621.315.624:621.316.545

REPLACEMENT OF GLASS PIN INSULATORS IN THE RLND-10/200 DISCONNECTOR

Moscow ENERGETIK in Russian No 12, Dec 79 pp 26-27

ALIYEV, M. M. and GREBENNIKOV, A. K., engineers

[Abstract] Frequent outages in the Dagestan power grid can be attributed to arcing of insulators on overhead lines due to contamination with salt borne by off-shore winds with subsequent soaking by fog and rain. The least reliable link in 6-10 kV distribution networks is the RLND-10/200 disconnectors. About 90% of all failures are due to breakdown of the ShS-10 and ShN-10 insulators. Since May 1975 these disconnectors have been updated by replacing the old insulators with the ShF-20V glass pin insulator. Since that time, not a single insulator has shown breakdown. Figures 2.

[6-6610]

ANALYSIS OF THE WATERWALL SYSTEM OF THE TGMP-204 BOILER OF THE 800 MW
BOILER-TURBINE UNIT AT THE ZAPOROZHSKAYA ELECTRIC POWER STATION

Moscow TEPLOENERGETIKA in Russian No 12, 1979 pp 38-42

BERSENEV, A. P. and GLUSKER, B. N., Soyuztekhnenergo All-Union Trust for
Power Technology

[Abstract] The TGMP-204 uniflow steam boiler, designed for operation in tandem with an 800 MW close-coupled condensing turbine, burns M100 mazut and natural gas. The hydraulic, temperature, and thermal operating modes of the waterwall system of this boiler, which was put into operation in 1975, were investigated under loads of 818-320 MW on the boiler-turbine unit. The waterwall system displayed an adequate operating reliability. However, the actual heat uptake by the waterwalls was found to deviate markedly from its designed value, owing to errors in the thermal analysis. The high local heat fluxes in the lower portion of the waterwall system, due (presumably) to the mutually close positioning of burners over the height of the boiler, cause the temperatures of the lower-section tubes to reach 530-540°C. Such temperatures do not adversely affect the long-time strength but are close to the critical temperatures from the standpoint of the high-temperature corrosion of the tubes. On the whole, the findings show that the maximum coefficients of temperature nonuniformity are no higher than 1.3. The findings served to recommend modifying the hydraulic design of the rear waterwall section so as to transport the heat transfer agent from the rear waterwalls only via riser tubes of 159x18 diameter and to use an autonomous hydraulic element as the horizontal-flue suspension. Figures 4; references 4 Russian.

[18-1386]

USSR

UDC 621.313.333

A DEVICE FOR MOTOR PROTECTION

Moscow ENERGETIK in Russian No 12, Dec 79 pp 25-26

KROPACHEV, I. G., engineer, Leningrad

[Abstract] A motor protector is proposed for preventing damage to induction motors due to failure of one phase, overloads and so forth. The basis of the protector is a single-junction transistor analog with one input connected through a diode to a timing capacitor, and through another diode and a stabilatron or dynistor to a capacitor that diverts part of the total current during starting or reversal of the motor. Another input of the single-junction transistor analog is connected to a voltage divider based on positrons or thermal resistors. The output of the analog is connected to the controlling electrode of a thyristor with the switching junction connected to the output of a voltage divider, a diode and the controlling junction of another thyristor. The switching junction of this device is connected in the diagonal of a rectifying bridge in series with the winding of a magnetic starter. Operation of the protector is explained. The proposed protector was installed on a 4.5 kW induction motor and has been successfully used for six months. Current and temperature protection are provided either separately or simultaneously. Figures 2.

[6-6610]

USSR

UDC 681.513:007.52

ON METHODS OF COMPUTING THE ORIENTATION ANGLE OF A PART FOR ADAPTIVE INDUSTRIAL ROBOT CONTROL SYSTEMS

Leningrad IZVESTIYA VUZov: PRIBOROSTROYENIYE in Russian Vol 22 No 8, Aug 79 pp 37-41 manuscript received 6 Oct 78

GLADSHTEYN, M. A. and KOMAROV, V. M., Rybinsk Aviation Technology Institute

[Abstract] The most difficult aspect of industrial robot handling of objects is grasping parts having an arbitrary orientation. The case of any extensive object, having an axis of symmetry, is treated in a two-dimensional representation of the object being manipulated. The parameters of the position of the two-dimensional figure are analyzed to define the orientation of the object in terms of the angle between the axis of symmetry and some initial reference line. This orientation angle is determined through the use of

circular scanning, which is invariant with respect to the displacement of the scanning center relative to the center of gravity of the object. A simple algorithm is derived for the computation of this orientation angle. The process of computing the angle reduces to the operation of addition with binary weighted quantities, enabling use of relatively simple adder design using integrated circuits. Figures 2; references 4 Russian. [24-8225]

USSR

UDC 681.2-2.001.24

AN AIR BEARING FOR ACCURATE LINEAR DISPLACEMENTS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 261-262 manuscript received 22 Mar 78

ARKHIPOV, V. V. and VALATSENKO, N. K.

[Abstract] A prototype of a low-friction air bearing for linear motion is described where the cushion is produced by injection of compressed air into the clearance between a floating cylinder inside and a stationary cylinder outside. Both cylinders are made of SAS-1 alloy and the lateral clearance between them is 10 μm . The stator is of a split construction for easy assembly. Air is fed through a hose and a filter to a hermetically sealed cavity in the stator, from where it is injected through an array of orifices to the clearance between stator and float, continuously under a pressure of 2 kgf/cm^2 . The performance of this bearing was measured in terms of the float tilt angle as a function of the float displacement along the bearing axis. Over a linear displacement of 16 mm, the tilt did not exceed $\pm 1.0^\circ$ in the vertical plane and $\pm 0.5^\circ$ in the horizontal plane. Such a bearing is suitable for moving a 30 mm mirror in a Fourier spectrometer. Figures 2; references 3 Russian. [31-2415]

USSR

UDC 621.941

SPEED CHARACTERISTICS OF MACHINES WITH COMPLEX TRANSLATIONAL-ROTATIONAL MOTION OF THE OUTPUT CONTROL ELEMENTS

Tbilisi SOOBASHCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian Vol 96 No 1, 1979 pp 141-144 manuscript received 31 May 79

IMEDASHVILI, G. K., Institute of Machine Mechanics, Academy of Sciences Georgian SSR

[Abstract] Various fields of machine building use machines in which the output control elements and workpieces execute rotational motions on eccentric circles in parallel planes. In this arrangement the output control elements are in complex rotational-translational motion with respect to the workpiece. It has been shown in previous research that the nature of the trajectory of the output control element depends on the ratios of the rotational frequencies of the output control element and the workpiece, and the ratio of the turning radius of the output element to the radius of the moving centroid of a planetary analog. In this paper the author determines the fluctuation in the speed of travel of the control elements along these trajectories. Figures 2; references 5 Russian.
[15-6610]

USSR

UDC 621.833-233.2-752.2-525

PNEUMATIC SHOCK ABSORBERS OF TRANSMISSION BEARINGS

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 12, 1979 pp 14-16

BIRULYA, A. L., IVANOV, YU. F., the late IGNAT'YEV, E. N., PORYADKOV, V. I., and SMIRNOV, V. N.

[Abstract] The dynamics of a gear-transmission stage in the presence of vibrations of 70-1000 Hz is investigated. It is shown that the use of air-filled rubber balloons as shock absorbers in the bushings of the gear bearings is an effective means of reducing the level of the vibrations due to imbalance of the rotating parts and the gear-meshing noise, within the rpm range of from 100 to 1100; the noise level then is reduced by as much as 10 dB. The experimental findings are in agreement with the theory. Figures 5; references 3 Russian.
[20-1386]

ROUGH MACHINING OF TITANIUM ALLOYS WITH THE AID OF SELF-ROTATING LATHE TOOLS

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 12, 1979 pp 32-33

DANILOV, V. A. and IVANOV, N. S.

[Abstract] Self-rotating cutting tools can also be used in rough machining of relatively churlish materials. In this connection, a tool of this kind, tipped with VK8 hard-alloy cutting edge, was experimentally used to machine rods of various titanium alloys (VTZ-1, VT8, VT9, VT14, VT20, VT22, and others) at cutting speeds of 20-45 m/min, a feed of 0.3-1 mm per revolution and a cutting depth of 3-7 mm. Comparison with the performance of conventional lathe tools demonstrated that the wear resistance and strength of self-rotating cutters are markedly greater, which is of interest from the standpoint of conserving tool materials and increasing the productivity of the rough machining of titanium alloys. Figures 3.
[20-1386]

USSR

UDC 621.436-752.001.24

INVESTIGATION OF THE VIBROACOUSTIC ACTIVITY OF THE GAS DISTRIBUTING MECHANISM OF A DIESEL ENGINE

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 12, 1979 pp 11-14

MARCHENKO, V. P.

[Abstract] Noise in the engine gas distributing mechanism is chiefly due to shocks accompanying the raising and lowering of the valves as a result of thermal clearances. These shocks generate vibrations which account for noise in cylinders, engine block, and other components. In this connection, a method for estimating the effect of design factors on the intensity of the vibrations is proposed. It is shown that the use of the kinetic energy of shock as the criterion for estimating the vibroacoustic activity of a mechanism is unjustified, since this cannot account for the known predominance of the noise due to shocks during the closing of the valve as compared with its opening. Vibration intensity is a better criterion, since the intensity ratio between the sound vibrations generated by shocks during the opening and the closing of the valves is a function of the elastic and dissipative properties of the system. The theoretical conclusions were confirmed by experimental findings and can thus be used to improve vibration-noise performance. Deviations from the derived pattern of variations in noise and vibration levels can serve as criteria for detecting abnormalities in the functioning of the mechanism. Figures 5; references 3 Russian.
[20-1386]

USSR

UDC 621.515.5-233.21:62-192.002.235

INCREASING THE RELIABILITY OF THE JOURNAL BEARINGS OF TURBOCOMPRESSORS

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 12, 1979 pp 16-19

VOL'SKIY, E. P., DEKHOVICH, D. A., IVANOV, G. I., KNEL'TS, V. P. and ZHURAKOVSKIY, A. P.

[Abstract] In modern high-speed turbocompressor rotors the selection of the design and dimensions of journal bearings is a complex problem in view of the complex attendant operating conditions. In this connection, the performance of such bearings under operating conditions was investigated at the Kolomna Diesel Locomotive Building Plant on a 6TK turbocompressor used to supercharge a diesel-locomotive internal combustion engine. The trajectory of motion of the shaft center and the metal temperatures at a distance of

1 mm from the sliding surface of the bearings were measured. In addition, the pressure and temperature of oil at the turbocompressor inlet and outlet were measured, as was the oil flow rate. The rotor rpm and gas temperature at the turbine inlet were determined with respect to specific working conditions. It was found that the principal criterion of the reliability of performance of turbocompressor bearings is the pattern of variation and amplitude of the shaft vibrations. Shaft vibrations with the relative amplitude $A = 0.97$ induce intense wear and breakdown of cylindrical bearings. As shown by 8,000-10,000 hour operating trials in diesel locomotives with turbocompressors, bearings with an elliptical bore display greater reliability and longer service life. Figures 5; references 3 Russian.
[20-1386]

USSR

UDC 629.13.014.69-506A

ON THE QUESTION OF REDUCING THE INFLUENCE OF GEODESIC UNCERTAINTIES ON
INERTIAL NAVIGATION SYSTEM ERRORS

Leningrad IZVESTIYA VUZov: PRIBOROSTROYENIYE in Russian Vol 22 No 8, Aug
79 pp 62-68 manuscript received 22 Nov 78

KARAKASHEV, V. A., ANUCHIN, O. N. and YEMEL'YANTSEV, G. I., Leningrad Institute of Precision Mechanics and Optics

[Abstract] Vertical analog errors in inertial guidance systems depend substantially on the deviations in the vertical plumb line. Since navigation maps are adjusted to a reference ellipsoid, the inertial system must generate the geodesic latitude and longitude, thus making it necessary to model the geodesic position vertical. The differential equations for the errors in modeling the normal to the reference ellipsoid are analyzed and ways of reducing the influence that plumb line deviations have on the errors in the analogs of the geodesic and true verticals are shown, where information on the second derivatives of the actual gravity field of the earth is employed. Since it is difficult to measure the vertical line deviation directly from a moving object, and these deviations have been mapped for only limited areas of the earth's surface, it is shown that these difficulties can be circumvented by using statistical models of the components of vertical deviation to derive reliable estimates. It is preferable to model the vertical plumb line in systems where gradiometers are used; the errors in constructing this line are invariant with respect to geodesic uncertainties, and the resulting information on the deviations of the plumb line is used to generate the geodesic navigational and kinematic parameters of the object at the system output. This also allows a transition to different reference ellipsoids without disturbing the vertical analog. References 10: 6 Western, 4 Russian. [24-8225]

USSR

UDC 629.7.054.874

UNCORRECTED ORBITAL GYROSCOPE

Leningrad IZVESTIYA VUZov: PRIBOROSTROYENIYE in Russian Vol 22 No 8, Aug
79 pp 68-70 manuscript received 3 Oct 78

GERASIMOV, A. N., Leningrad

[Abstract] The lack of torque sensors in uncorrected orbital gyros reduces the rate of their inherent drifts and consequently, their errors. It is proposed that the yaw angle of an orbiting spacecraft be determined

analytically from the measured values of the roll angle of the orbital gyro. A gimbal-mounted uncorrected gyro configuration is analyzed with the following assumptions: The orbit is close to circular; the angles of yaw and roll are small; the angle of rotation of the local vertical in the orbital plane relative to an arbitrary reference direction in this plane is zero. Analog and digital yaw angle computers are considered. A drawback to the analog system is the need to use rotating transformers. A block diagram of a configuration using only two integrators is shown and expressions are derived for the yaw and roll angle errors. Figures 3; references 4 Russian. [24-8225]

USSR

UDC 621.375.826.08

FREQUENCY STABILIZATION OF A CO₂ LASER THROUGH FLUORESCENCE OF GASEOUS CO₂

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 10, Oct 79 pp 18-19

DOMNIN, YU. S., KARDASHOVA, L. M., TATARENKOV, V. M. and SHUMYATSKIY, P. S.

[Abstract] The frequency of a CO₂ laser at any line within its vibrational-rotational spectrum (9-11 μm) can be stabilized only within the CO₂ gas. Frequency stabilization through an inverted Lamb shift, or power peak, is very inefficient and requires a large absorption cell with a gaseous mixture under a high pressure adequately heated. Stabilization through resonance of the fluorescence signal at the 4.3 μm wavelength of spontaneous transition has been proposed instead. Experiments were performed with a CO₂:N₂:He = 1:1:4 mixture in a small 8 mm long cell, a 0.5 m long discharge gap, with a diffraction grating for emission line selection and a large spherical mirror of a 4 m radius forming the resonator cavity. A photoreceiver with a large sensitive area was used for collecting the spontaneous radiation spread over a wide solid angle. It was found possible to narrow the nonlinear fluorescence resonance, as indicated by the discrimination curve, and to attain a sufficiently high signal-to-noise ratio with CO₂ under a pressure of 10-27 Pa for stabilizing within $7 \cdot 10^{-11}$ the frequency of a 0.5 W unsealed CO₂ laser emitting at the $\lambda = 10.6 \mu\text{m}$ wavelength. Figures 2; references 5: 3 Russian, 2 Western.

[30-2415]

USSR

UDC 621.373.826:621.375.826:62-502.3

A HIGHLY STABILIZED MEDIUM-POWER RADIATION SOURCE

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 79 pp 33-36

YELISEYEV, P. G., YERMAKOVA, M. V., ZAGORSKIY, YA. T., STRAKHOV, V. P., STYSIN, V. YE., TIKHOMIROV, S. V., KHATYREV, N. P., KHLESKOVA, T. N. and YAKOVLEV, V. A.

[Abstract] A medium-power source of optical radiation has been built which consists of a GaAs injection laser inside a nitrogen cryostat. With an injection current of 1.5-3 A, it delivers 0.3-1.5 W of radiation at the 0.87 μm wavelength. It is pumped from a stable supply through measuring and ballast resistors. Its radiation is transmitted through optics with power stabilization to a light conductor. Power stabilization within 0.01% is achieved by means of a negative feedback system including an optical wedge,

an image converter, a photodiode photoreceiver, a reference-voltage generator, a differential amplifier, and a control-current resistor. The cryostat temperature is, moreover, stabilized within $\pm 0.02^\circ\text{C}$ by means of a thermostat. This radiation source is matched to a Government Primary Standard optical radiation receiver with a vacuum chamber. Figures 2; references 6: 4 Russian, 2 Western.
[28-2415]

USSR

UDC 621.375.826

A PULSE SOURCE OF LASER RADIATION ENERGY

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 79 pp 36-37

YELAGIN, A. YU., VASIL'YEV, YU. S., ROMASHKOV, A. P., ULANOVSKIY, M. V. and KHAYKIN, N. SH.

[Abstract] A pulse source of laser energy has been built which consists of a highly stable single-mode one-frequency CO_2 laser emitting radiation at the $\lambda = 10.6 \mu\text{m}$ wavelength. The continuous radiation passes through an optomechanical shutter-chopper, where it is mixed with radiation from an auxiliary He-Ne laser. The latter, together with an image converter and a recording system serves to measure the duration of generated energy pulses. The chopper produces nearly trapezoidal pulses, its mechanical part is a tape transport mechanism driven by two reversible electric motors through speed reducers. The main laser delivers a power of 1.0 W stable within 0.7%, the radiation is polarized linearly in the vertical direction, with a beam divergence within 0.003 rad, a frequency instability within 10^{-7} - 10^{-8} and a nearly normal distribution of power density. Figures 2.
[28-2415]

USSR

UDC 535.853.4:621.375.826

ANALYSIS OF MEASUREMENT METHODS USING LASER INTERFEROMETERS

MOSCOW IZMERITEL'NAYA TEKHNIKA in Russian No 12, Dec 79 pp 23-24

KHANOV, V. A. and KORONKEVICH, V. P.

[Abstract] The paper gives the results of a comparative analysis and experimental check of the accuracy of two methods of using laser interferometers for length measurement: 1. direct comparison of the measured length with the wavelength of the radiation in a vacuum, using a scaling factor that accounts for thermal expansion and the index of refraction of air; 2. using the interferometer as an interpolator, and determining the scaling factor from results of measurement of the length of a known reference body. It is shown that the absolute method of measuring the length of material bodies is the most exact at the present time. However, if a measurement error of $(1-5) \cdot 10^{-6}$ can be tolerated, a line test pattern can be used as the length standard, and the interferometer can be used as an interpolator. This obviates the need for a laser with a certified wavelength and continuous monitoring of changes in the temperature of the workpiece and the index of refraction of air. Figures 2; references 7: 4 Russian, 3 Western.
[16-6610]

USSR

UDC 535.853.4:53.087.92

TWO-FREQUENCY POLARIZATION INTERFEROMETERS

MOSCOW IZMERITEL'NAYA TEKHNIKA in Russian No 12, Dec 79 pp 25-28

ZASTROGIN, YU. F. and BELEVITNEV, V. R.

[Abstract] Two-frequency interferometers can be divided into polarization and spatial systems. In the former, coherent emission is separated into reference and measurement arms with respect to polarization, while in the latter, the frequency-displaced components of coherent radiation are spatially separated into reference and measurement beams. Simpler instruments are two-frequency polarization interferometers designed for converting single-frequency coherent emission to two-frequency radiation by using mechanical and electro-optical devices. These devices operate on the principle of transmitting coherent emission through birefringent components. The authors consider various interferometers of this type with characteristics that depend on the quality of operation of the converters. It is

shown that interferometers with polarization converters based on a rotating phase plate produce an output signal carrier frequency in a range of up to 2 kHz, enabling measurement of the parameters of motion of an object down to 0.6 mm/s. Interferometers with electro-optical converters can be used to study high-speed processes. The carrier signal of the output signal of such interferometers lies in range of from 2 kHz to 10-20 MHz, enabling measurement of motion parameters at a velocity of up to 10 m/s. Figures 3; references 3: 1 Russian, 2 Western.
[16-6610]

USSR

UDC 621.373.8

MEASUREMENT OF SHORT-TERM INSTABILITY OF LASER RADIATION FREQUENCY BY FILTERING FREQUENCY NOISES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 12, Dec 79 pp 30-33

SOLOV'YEV, V. S., FERTIK, N. S. and SHAFOROSTOV, A. I.

[Abstract] Conventional methods of measuring the frequency instability of rf oscillators are not applicable to lasers in the time range of 10^{-4} -1 s. The authors propose a method that is applicable in this time range for large absolute values of frequency fluctuations. A stable reference oscillator and photocell are used to shift the spectrum of frequency fluctuations of the laser into the rf band. The amplified beat signal is sent to a frequency discriminator for frequency-to-voltage conversion. From the discriminator output, the analog signal goes to tunable bandpass filters, and the filter output is measured by an effective voltage meter. The method is most effective in measurement time intervals of less than 0.1 s. Figures 2; references 9: 4 Russian, 5 Western.
[16-6610]

THE INFLUENCE OF VIBRATIONS ON VISUAL RESOLUTION AND RECOGNITION OF OBJECTS WITH A COMPLEX SHAPE

Leningrad IZVESTIYA VUZov: PRIBOROSTROYENIYE in Russian Vol 22 No 8, Aug 79
pp 71-74 manuscript received 3 Feb 78

KOSNIKOVSKIY, V. A., Leningrad Institute of Precision Mechanics and Optics

[Abstract] A test object of arbitrary shape is positioned in the focal plane of an objective (diameter 40 mm, $f = 400$ mm) and observed through an optical system with a magnification of 20. Apparent oscillations of the test object image were produced by an electromagnetically controlled mirror which could vary the frequency of image vibration from 0 to 100 Hz and the amplitude from 0 to 18 angular minutes with a precision of 0.1% and 0.2% respectively. A number 3 graduated Foucault absolute contrast test pattern, oriented perpendicular to the direction of the vibrations, was used as the test object. The amplitude of the vibrations ranged from 0 to 15', a value equal to half the angle of the instrument field of view. Three major cases were ascertained: 1) Where the amplitude of the vibrations is greater than half of the field of view and the extreme positions of the object are not visible to the operator, recognition was determined by the ability of the eye to follow the moving image, and was limited to about 3 to 4 Hz and an amplitude of 16' with a field of view of 0.5°. A further increase in the frequency required an increase in the size of the object (by a factor of three for 6 Hz), and above 8 Hz, recognition was impossible under these conditions; 2) Where the amplitude ranged from half of the angular size of the object to half of the field of view of the optical instrument, the operator received practically error free information on the type of object, by observing it at the extreme positions; 3) Where the amplitude of the vibrations were less than the angular dimensions of the object, vibrations in a direction perpendicular to the length of the object caused practically no problems in recognizing the type of object, though vibrations along the length of the object permitted its recognition only when a priori information was available. The results are illustrated by a graph showing the resolution in angular seconds as a function of the vibration frequency for amplitudes from 18" to 16'. Figures 2; references 5 Russian.
[24-8225]

AN ANALYSIS OF CHROMINANCE FLUCTUATIONS IN COLORIMETRIC SYSTEMS WITH ADDITIVE NOISE

Leningrad IZVESTIYA VUZov: PRIBOROSTROYENIYE in Russian Vol 22 No 8, Aug 79 pp 74-80 manuscript received 12 Dec 78

FEDCHENKOV, K. A., Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin)

[Abstract] When spectral scanning systems are used as colorimetric transducers in the automated analysis of image chrominance, there are increased noise fluctuation levels. The influence of the noise parameters of a colorimetric system on the probability characteristics of the quantities being measured, including the chrominance coordinates, is analyzed. By considering the ellipsoid which represents the surface bounding the equiprobable color fluctuations in chrominance space, where the major axes of the ellipsoid are parallel to the coordinate axes of the chrominance space, an analytical expression is derived for the differential law governing the composite distribution of the noise fluctuations of the chrominance signal. The resulting expression is interpreted geometrically and the nature of the impact of the noise parameters on the degree of scatter in the chrominance coordinates relative to their true value is also analyzed. This latter analysis is of practical importance, since it yields a measure of the probability that the chrominance fluctuations will not exceed a specified range in a chrominance diagram. It is found that the errors in the color coordinates reach their maximum values faster, the greater the inequality between the noise intensities in the chrominance channels of the transducer. The derived expressions are suitable for engineering calculations of the precision in the determination of the chrominance coordinates where scanners are used for automated color image analysis. Figures 4; references 3 Russian. [24-8225]

SOME QUESTIONS IN THE DESIGN OF A DEVICE FOR THE COHERENT ILLUMINATION OF AN OBJECT FOR CINEMATOGRAPHY

Leningrad IZVESTIYA VUZov: PRIBOROSTROYENIYE in Russian Vol 22 No 8, Aug 79 pp 81-84 manuscript received 26 Dec 78

NATAROVSKIY, S. N. and TSUKANOV, A. A., Leningrad Institute of Precision Mechanics and Optics

[Abstract] A laser is used to illuminate an object which is photographed by a motion picture camera. In computing the factors which influence object illumination and image intensity, two cases are considered: 1) The object scatters the light practically without diffusion; 2) The object scatters the light diffusely. In both of these cases, the object can be illuminated by a single light wave from a laser or by a multiplicity of coherent light waves by splitting the wave front from a laser. Specific examples are adduced to show that it is possible to achieve high illumination intensities of the image without using high power lasers, even where large fields are illuminated. Two laser optical configurations are shown for cinematography: the first uses lenses to magnify and collimate the laser beam prior to silhouetting the image, and the second utilizes a parabolic mirror for this. A photograph made with a "Zenit" camera with "Mikrat-300" film and an exposure time of 0.002 s, where an LG-75 laser was used, is shown. The advantages of this approach are: a reduction in the influence of the aperture of the photographic objective on the image intensity, reduced exposure times and the optical systems are simple and well suited for industrial production. Figures 3; references 4 Russian.
[24-8225]

AN ACCELERATOR OF HIGH-CURRENT MICROSECOND ELECTRON BEAMS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 32-35 manuscript received 25 May 78

BURTSEV, V. A., VASILEVSKIY, M. A., GUSEV, O. A., ROYFE, I. M., SEREDENKO, YE. V. and ENGEL'KO, V. I.

[Abstract] High-current electron beams of microsecond pulse duration are generated by a diode with magnetic shielding in the "Sid" accelerator. The distinctive features of this device are a shielding solenoid designed for relativistic electron velocities and energized from a bank of 11 ceramic

capacitors through a segmental choke coil and with an ignitron commutator. The high-voltage source is a 40 kJ Arkad'yev-Marks generator with isolation consisting of 8 stages of 4 air capacitors each. The cathode consists of two coaxial tubes made of stainless sheet steel, part of the surface normal to the magnetic force lines, and can be moved axially through several centimeters without loss of vacuum. The anode in the form of a frustum at a cone is also made of stainless sheet steel, its surface being parallel to the magnetic force lines. This construction ensures a high concentration of the electric field over the active part of the cathode assembly, adequate magnetic shielding of the anode, and some adjustability of the diode geometry. Figures 2; references 6: 3 Russian, 3 Western.
[31-2415]

USSR

UDC 621.384.6

A PULSING ION INJECTOR FOR AN ELECTROSTATIC ACCELERATOR WITH BUNCHING IN A DISTRIBUTED ELECTRIC FIELD

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 39-41
manuscript received 15 May 78

BELOV, A. S., BURMISTROV, YU. M. and YURCHENKOV, Institute of Nuclear Research, USSR Academy of Sciences, Moscow

[Abstract] An ion injector for an electrostatic accelerator has been built in which nanosecond ion pulses are produced by chopping of the continuous ion beam with rectangular voltage pulses and subsequent bunching of the ion current pulses. The buncher with a distributed electric field is used with the EG-2.5 electrostatic proton source. It consists of a cylinder and a diaphragm at a constant potential corresponding to the energy of ions before bunching, another diaphragm to which a voltage with an amplitude corresponding to the energy of ions after bunching is applied, and a third diaphragm between the two which receives a voltage from a resistive-capacitive divider to compensate the field dip at the center of the buncher. The pulse voltage at the buncher is synchronized with the chopper voltage through a 120 ns delay line, the delay time being independent of the bunch repetition rate, and the amplitude of the buncher voltage can be varied up to 3 kV. The rise time of a buncher pulse is 25 ns. The apparatus also includes an electrostatic lens before the chopper plates and a target with a grid and with a coaxial cable to an oscillograph behind the buncher. The authors thank V. I. POPOV for the interest, also V. A. ROMANOV, A. I. GLOTOV and V. N. KANAKI for the assistance in constructing the ion source and for the helpful comments. Figures 3; references 5: 4 Russian, 1 Western.
[31-2415]

USSR

UDC 539.107.4:523.165

CALCULATION OF THE PHYSICAL CHARACTERISTICS OF A CERENKOV-SCINTILLATION
GAMMA TELESCOPE BY A MONTE CARLO METHOD

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 75-77
manuscript received 29 Feb 78

GUN'KO, N. A., GUR'YAN, YU. A. and TROPP, E. A., Physico-Technical Institute,
USSR Academy of Sciences, Leningrad

[Abstract] A gamma telescope is mounted on the Kosmos-461 satellite for study of hard gamma radiation in the earth's atmosphere. Its physical characteristics were calculated by a Monte Carlo method, also used for calibration of other astronomic gamma instruments in the high-energy range. The principal physical characteristics, namely the sensitivity diagram, has thus been determined in terms of the effective converter area as a function of the energy and of the incidence angle of impinging quanta, this effective area being equal to the geometrical area multiplied by the probability of quanta registration. In the computer program the trajectory of a particle was simulated taking into account generation of electron-positron pairs as well as Compton scattering of gamma quanta and multiple Coulomb scattering of electrons. The calculations have yielded, as a result of numerical integration with respect to the angle, the differential geometric factor relating the count rate of the instrument to the radiation intensity of a monoenergetic flux and depending on the energy of the gamma radiation flux. The integral geometric factor, properly weighted, refers to the entire energy spectrum above the threshold level. Figures 3; references 6: 3 Russian, 3 Western. [31-2415]

USSR

UDC 621.039.6

A DEVICE FOR INJECTION OF MACROPARTICLES INTO A HOT PLASMA

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 163-165 manuscript received 25 Apr 78

KUTEYEV, B. V. and SHATALIN, S. V., Leningrad Polytechnic Institute

[Abstract] Large particles of a refractory material with a high thermal conductivity can serve as probes, when injected into a plasma, for diagnosis of local plasma characteristics without significant distortion of the energy balance. A gun has been built which shoots such particles vertically up into the hot plasma discharge region. A slotted disk holds 90 balls around its

periphery and acts as a revolvable loader, nesting one ball at a time in the tip of a firing pin inside a barrel with a bellows. The device includes a holding d.c. electromagnet movable vertically by means of a drive screw and controlling the motion of the firing pin, also a synchronizing relay. The gun is joined to the plasma chamber through a flange coupling. The gun is actuated by atmospheric pressure. The authors thank A. P. ZHILINSKIY and I. YE. SAKHAROV for the interest in this project, also YU. A. ZAYTSEV for the performance of basic mechanical tasks. Figures 1; references 5: 3 Russian, 2 Western.
[31-2415]

USSR

UDC 621.3.032.2.691:621.387.3

AN ELECTRON GUN WITH A PLASMATIC CATHODE AND A BUILT-IN COMPACT GAS GENERATOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 169-171
manuscript received 15 May 78

GRUSDEV, V. A., KREYNDEL', YU. YE. and TROYAN, O. YE., Tomsk Institute of Automatic Control Systems and Radioelectronics

[Abstract] An electron gun with a plasmatic cathode is described which also has a built-in gas generator. The latter is a solid pellet of 99% ammonium nitrate with 1% chromium oxide which, upon being heated, decomposes producing a gas. This gas enters a Penning discharge tube through a hollow cathode made of magnetic stainless steel, as is another cathode on the end of a cylindrical copper anode. Both cathodes are insulated from the anode by Teflon spacers. The magnetic field is produced by a permanent ring magnet. Electrons are extracted from the plasma through another electrode with a cylindrical hole which is electrically connected to both cathodes in the discharge tube. The extraction system is insulated from the discharge system by a high-voltage epoxy compound with a talcum filler. The gas flow into the discharge tube can be stabilized within the 60-80 cm³·atm/h range by means of a bellows. This gun can be operated in the pulse mode, with a pulse discharge voltage and a constant extraction voltage, yielding the same dependence of the beam current on the discharge current and on the extraction voltage as in the case of continuous operation. An ion beam of up to 30 mA can be formed by reversal of the polarity of the extraction voltage. Figures 3; references 3 Russian.
[31-2415]

USSR

UDC 537.534.2

AN ION SOURCE FOR STUDY OF CHARGE EXCHANGE PROCESSES ON ATOMS OF METALS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 177-179 manuscript received 10 Mar 78

GALL', R. N., KIR'YAKOV, N. V., MARKIN, M. I., TAL'ROZE, V. L. and TIRKEL'-TAUB, S. V., Institute of Chemical Physics, USSR Academy of Sciences, Moscow

[Abstract] An ion source has been built, to be used with the MKh-1305 double magnetic mass-spectrometer, for measuring the cross section of charge exchange of ions on metal atoms. The apparatus includes, in addition to the basic ion-optical system, also an evaporator. The latter consists of a molybdenum crucible into the lid of which is screwed a tungsten decanter plate with approximately 6000 parallel $1 \times 6 \text{ mm}^2$ orifices in a tantalum frame. The temperature of the crucible can be raised and maintained at 1000°C by a 45 W heater. Vapor of a metal flows from the evaporator through a cylindrical fitting of an external shield to the charge exchange chamber, this chamber and the evaporator being at the same potential. Heat losses in the evaporator are reduced by a 20-layer shield of polished tungsten foil around the crucible. The temperature is measured with nickel-nichrome thermocouples. This apparatus was tested in an experiment with charge exchange of organic ions on magnesium atoms. The density of magnesium vapor at various temperatures up to 950°C was measured by comparing the Mg^+ ion current with the ion current of a reference Ne^+ gas under a known pressure. Figures 2; references 7: 6 Russian, 1 Western.
[31-2415]

USSR

UDC 621.373.826:681.535

A SYSTEM FOR STABILIZING THE RADIATION POWER OF A CO_2 -LASER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 186-189 manuscript received 15 Jun 78

MARTYNYUK, A. S., All-Union Scientific Research Institute of Physico-technical and Radiotechnical Measurements

[Abstract] Fluctuations of the radiation power from a CO_2 laser are compensated by automatic regulation of the discharge current relative to the signal from a reference radiation receiver. The optical part of this system includes an LG-23 laser, a silicon wedge of high electrical resistivity, a sectoral modulator and a pyroelectric radiation receiver. The electronic

part includes a preamplifier, a rectifier, an analog memory, operational amplifiers, transistor switches, a kipp oscillator and a stabilatron. The system operates as a static system of discrete regulation with pulse amplitude modulation. Connecting this system into the open feedback loop can reduce power fluctuations from $\pm 10\%$ to $\pm 0.2\%$, the accuracy of stabilization being limited mainly by the instability and the band nonuniformity of the conversion coefficient in the reference radiation receiver. The system is used with instruments for measuring the attenuation coefficient in optical components. Figures 3; references 6: 3 Russian, 3 Western. [31-2415]

USSR

UDC 778.38.034

HOLOGRAPHIC DEFLECTORS OF LASER BEAMS

Moscow TEKNIKA KINO I TELEVIDENIYA in Russian No 12, 1979 pp 37-42

KISELEV, N. G., Leningrad Institute of Cinema Engineers

[Abstract] Scanning devices based on holographic deflectors (HD) in which the laser beam is deflected by means of a so-called holographic drum, a matching optical system, and a power drive, are considered. The design of HD-based one- and two-dimensional scanners is examined. It is shown that on the basis of the existing non-silver recording media it is by now feasible to develop a holographic deflector that satisfies the requirements of the TV standard and gives a sufficiently high diffraction efficiency. The problem of developing the existing versions of HD on the basis of focusing holograms that do not require an additional lens still remains unsolved. However, there is a technique for eliminating defocusing by pre-distorting the shape of the wavefront of the reference beam. In cases in which bending of the photographic recording material is permitted, the development of HD on the basis of the available designs is a purely technical problem. It is still necessary to further develop the theory of two-dimensional HD before satisfactory technical design solutions as regards the number of frame lines and the quality of the entire frame can be attained. Figures 7; references 20: 3 Russian, 17 Western. [17-1386]

USSR

UDC 621.039.553.34

THERMOHYDRAULIC CALCULATION OF HEAT EXCHANGERS WITH NONUNIFORM COOLANT FLOW IN THE TUBE BUNDLE

Moscow ATOMNAYA ENERGIYA in Russian Vol 47 No 5, 1979 pp 318-321 manuscript received 13 Oct 78

SUBBOTIN, V. N., MITENKOV, F. M., BORISHANSKIY, V. M., BUDOV, V. M., GOLOVKO, V. F., GOTOVSKIY, M. A., YEFANOV, A. D., KOLMAKOV, A. P., MIZONOV, N. V., USHAKOV, P. A., FIRSOVA, E. V. and YUR'YEV, YU. S.

[Abstract] The shell-and-tube heat exchangers used in liquid-metal-cooled fast reactors are characterized by nonuniformity of flow and temperature over their cross section which, if substantial, can reduce the efficiency of the heat exchangers. Given the inadequacy of the existing techniques of thermohydraulic analysis of such heat exchangers, a new approach to their analysis is proposed, based on the homogeneous model in which the multiply connected domain represented by a tube bundle consisting of several thousand tubes is replaced with a singly connected domain in which the temperature and velocity profiles correspond to their averaged counterparts in real heat exchangers. An exact system of the pertinent differential equations of motion and energy in dimensionless form in cylindrical coordinates is given, and it is shown that dimensionless parameters of the macroprofiles of coolant velocity, pressure, and temperature make it possible to analyze the conditions of the thermohydraulic modeling of heat exchangers. Fundamentally these conditions reduce to assuring geometrical similarity, equality of the Reynolds numbers and water equivalent ratio of coolants, and also equality of Stanton numbers derived from the heat transfer coefficient. Figures 4; references 12: 11 Russian, 1 Western.

[10-1386]

USSR

UDC 621.8

CALCULATION OF JOURNAL BEARINGS ON LIQUID METAL LUBRICATION

Moscow IZVESTIYA VUZov: MASHINOSTROYENIYE in Russian No 12, 1979 pp 70-75
manuscript received 26 Apr 79

BEKNEV, V. S., doctor of technical sciences, professor, and MOROZOV, V. N.,
graduate student

[Abstract] The authors consider the advantages of using low-melting eutectic alloys of heavy metals such as Pb-Bi to lubricate the bearings of high-power turbines. A technique is proposed for calculating the hydrodynamic parameters of journal bearings using such a lubricant, assuming laminar flow. The supporting power of the layer of lubricant is taken as the minimum when $Re > 1300$ and when the average temperature of the layer is $t_{av} = idem$. The fraction of the total energy of the flow of lubricant in the gap that is dissipated as heat is taken as $A = c\Delta t / \omega \nu Re^{2/3}$ when $Re \leq 1300$, and $A \sim Re^{5/4}$ when $Re > 1300$, where c is the specific mass heat of the lubricant, ω is the angular velocity of the shaft and ν is the coefficient of kinematic viscosity. Analysis of the static parameters of such a bearing shows that it is operable over the entire range of journal diameters for turbine bearings. Figures 2; references 10: 9 Russian, 1 Western.
[3-6610]

USSR

UDC 536.21

ON THE QUESTION OF THE PROPAGATION OF A TEMPERATURE FIELD IN A MULTILAYER MEDIUM

Leningrad IZVESTIYA VUZov: PRIBOROSTROYENIYE in Russian Vol 22 No 8, Aug 79 pp 91-95 manuscript received 3 Nov 78

KUZ'MINA, M. P. and OBORIN, L. A., Leningrad Structural Engineering Institute

[Abstract] The problem of the propagation of a temperature field in an infinitely long composite cylinder composed of three coaxial layers is analyzed for the case where the internal cylinder is a linear heat source of constant power (the probe) and corresponding thermal contact resistances are present at the interfaces of the component homogeneous layers. The temperature distribution through the cross-section of the internal cylinder and the axial heat flow are neglected. Partial differential equations are written and solved using an asymptotic approach to derive approximate

analytical expressions for the steady-state temperature field. The analysis of the three layer medium shows that the use of a probe, such as previously employed to measure the thermal diffusivity and conductivity of homogeneous materials, can also be extended to the determination of the heat exchange coefficients at the boundary of two contiguous homogeneous layers, which is of considerable practical interest in the case of new multilayer panel structures. Figures 1; references 5: 4 Russian, 1 Western.
[24-8225]

USSR

UDC 532.526

PRESSURE CALCULATION IN THE LINEAR PROBLEM OF A VIBRATOR IN A SUPERSONIC BOUNDARY LAYER

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43 No 6, Nov/Dec 79 pp 1014-1028 manuscript received 20 Nov 78

TERENT'YEV, YE. D., Moscow

[Abstract] The author considers flow around a thermally insulated body made up of a quiescent flat plate that becomes a triangular vibrator and terminates in a stationary flat plate. The dimensions of the vibrator and the frequency of the oscillations are such that supersonic flow around the body can be described by the equations of a boundary layer with self-induced pressure. The amplitude of the oscillations is taken as a small parameter, and the problem is linearized by expanding the unknown functions in a series with respect to this small parameter. Fourier transformation with respect to the longitudinal coordinate is used to construct the solution. The inverse Fourier transform is found by numerical methods. It is shown that the vibrator-induced flow perturbations are damped both upstream and downstream. The author thanks O. S. Ryzhov and V. I. Zhuk for discussion. Figures 7; references 12: 7 Russian, 5 Western.
[2-6610]

ELECTROHYDRODYNAMIC FLOW IN A DECELERATING ELECTRIC FIELD WITH CONSIDERATION OF THE INERTIA OF CHARGED PARTICLES

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43 No 6, Nov/Dec 79 pp 1029-1039 manuscript received 25 Dec 78

VATAZHIN, A. B. and GRABOVSKIY, V. I., Moscow

[Abstract] The authors consider one-dimensional motion of a two-phase medium in which the carrier is a neutral incompressible fluid (gas), and the dispersed phase is formed by spherical particles that carry an electric charge. It is assumed that the medium is flowing in a decelerating electric field, where the inertia of the charged particles necessitates using the complete equation of momenta for the charged component. It is shown that despite a vanishingly small volume of the space taken up by the particles in the initial cross section of the flow, when the particles are slowed down by an external homogeneous electric field (without considering the induced field) there is a section where the particles move with a small (but finite) velocity with finite relative volume of the charged component. On this section the interaction of the charged and neutral components is always considerable, although there may be no interaction at all in the initial section. The authors determine the pressure differential necessary for setting up such a flow. An analysis is made of flow with consideration of the induced electric fields that reduce the effect of rising concentration of the charged particles. The authors thank G. G. Chernyy and G. A. Lyubimov for constructive criticism. Figures 5; references 6 Russian.
[2-6610]

VIBRATIONS OF A THIN-WALLED STRUCTURE WITH LIQUID IN THE PRESENCE OF A HYDRODYNAMIC ENERGY DISSIPATOR

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43 No 6, Nov/Dec 79 pp 1095-1101 manuscript received 29 Sep 78

BUZHINSKIY, V. A., Moscow

[Abstract] The author considers a model of a hydrodynamic energy dissipator in which the shell is formed by a bellows with stiff covers. The lower cover is secured to a support bulkhead by stiff rods, and the upper cover is movable. A dashpot is located in the resultant gas cavity. An investigation is made

of the influence that the proposed energy dissipator has on axisymmetric oscillations of a shell with a sloshing liquid, and on combined longitudinal oscillations of the structure and axisymmetric longitudinal-transverse oscillations of the shell with liquid. It is shown that the use of an energy dissipator considerably improves the damping of oscillations of the structure on certain frequencies. The author thanks G. N. Mikishev for formulating the problem. Figures 2; references 3 Russian.
[2-6610]

USSR

UDC 533.6.011:534.222.2

ON THE PROBLEM OF ONSET OF A SHOCK WAVE WITHIN A LOCAL SUPERSONIC REGION

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43 No 6, Nov/Dec 79 pp 1117-1118 manuscript received 10 Jan 79

IVANOV, V. A. and CHERNOV, I. A., Saratov

[Abstract] The authors consider the approximate system of transsonic equations $uu_x = v_y$, $u_y = v_x$, where u and v are the adjusted dimensionless velocities of perturbation of the uniform sonic stream, x and y are cartesian coordinates. An exact solution is examined as a generalization of the self-similar solution for flow far from a wing. The proposed generalization describes flow around a certain half-body in a stream of gas that is subsonic at infinity. The characteristics of one family are reflected from the sonic line, and become compression waves that begin to intersect at some point K within the local supersonic region, forming an envelope (boundary line) with a cusp at point K . The point K is close to the sonic line, and its distance can be used to evaluate the accuracy of numerical methods. The authors thank S. V. Fal'kovich for interest in the work. Figures 1; references 5: 2 Russian, 3 Western.
[2-6610]

INTEGRATION OF THE UNSTEADY EQUATION OF HEAT EXCHANGE OF BODIES MOVING IN A FLUID

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43 No 6, Nov/Dec 79 pp 1119-1122 manuscript received 19 Oct 78

GUPALO, YU. P., POLYANIN, A. D., PRYADKIN, P. A. and RYAZANTSEV, YU. S., Moscow

[Abstract] The authors consider the unsteady problem of convective heat exchange of bodies of arbitrary shape moving in an ideal fluid, or of drops moving in an incompressible fluid. The analysis is done in the framework of the thermal boundary layer approximation. The solution is illustrated by analysis of the plane problem of heat exchange of a cylinder in a flow of ideal incompressible fluid with variable velocity. References 4: 3 Russian, 1 Western.
[2-6610]

USSR

UDC 539.3

THE METHOD OF STRATIFICATION IN THE THEORY OF THIN SHELLS

Moscow PRIKLADNAYA MATEMATIKA I MEKhanika in Russian Vol 43 No 6, Nov/Dec 79 pp 1058-1064 manuscript received 18 Dec 78

TANANAYKO, O. D., Leningrad

[Abstract] By making certain simplifications in the physical and geometric relations for potential energy and angles of rotation of shell elements under a strain, it is shown that a shell can be "stratified" in such a way that the fibers of each of the two layers are deformed like thin rods with axes that coincide with the lines of principal curvatures of the middle surface of the shell. It is shown that there are two families of such rods with six ordinary forces of interaction operating between them at any point of the middle surface. Three simple examples of stratification of two-dimensional objects are given. Figures 2; references 10: 8 Russian, 2 Western. [2-6610]

USSR

UDC 539.3

THE METHOD OF HOMOGENEOUS SOLUTIONS IN THE MIXED PROBLEM FOR A CIRCULAR CYLINDER OF FINITE DIMENSIONS

Moscow PRIKLADNAYA MATEMATIKA I MEKhanika in Russian Vol 43 No 6, Nov/Dec 79 pp 1073-1081 manuscript received 23 Feb 79

CHEBAKOV, M. I., Rostov-na-Donu

[Abstract] An examination is made of the mixed axisymmetric problem of elasticity theory on twisting of a circular cylinder by a punch that is secured to a flat face of the cylinder, while the boundary of the cylinder and its lateral surface are stationary. The problem is solved by applying the method of homogeneous solutions to the equivalent boundary value problem relative to the function of displacement along the axis of the cylinder. This technique gives an approximation for nearly any parameters. This is because the solution reduces to investigation of an infinite algebraic system of the Poincare-Koch type. When the height of the cylinder is sufficiently large compared with the radius of the punch, the coefficients of the system, the contact stresses and other parameters of the problem can be calculated with any degree of accuracy. In other cases, effective asymptotic expressions can be found. The author thanks V. M. Laeksandrov for interest in the work and discussion of the results. References 9 Russian. [2-6610]

USSR

UDC 539.383

CONTACT PROBLEM FOR TWO MICROINHOMOGENEOUS HALF-SPACES

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43 No 6, Nov/Dec 79 pp 1082-1088 manuscript received 9 Nov 78

AMELINA, Z. V. and ROMANOV, V. A., Moscow

[Abstract] The authors consider two randomly inhomogeneous half-spaces in which a macrohomogeneous stress-strain state is realized. An analysis is made of the interaction of the half-spaces in the plane of contact by the method of perturbations. The correlation functions and variances of strains are determined in finite form in the first approximation. Numerical values are given for the coefficients that characterize the stress concentration on the boundary of interaction of the half-spaces. An investigation is made of the change in these coefficients as a function of the ratio between the elastic moduli of media filling the half-spaces. It is shown that the stress concentration on the interface may be considerable, and should be considered in practical calculations. References 6 Russian.
[2-6610]

USSR

UDC 531.31

SOME CASES OF DETERMINATION OF TRAJECTORIES FOR TWO-DIMENSIONAL CONSERVATIVE MOTION OF A MATERIAL POINT

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43 No 6, Nov/Dec 79 pp 1111-1113 manuscript received 12 Sep 78

GOLIKOV, YU. K. and MATYSHEV, A. A., Leningrad

[Abstract] The problem of motion of a material point in a two-dimensional field has been solved in quadratures only for Liouville systems. The class of problems that are integrable in quadratures can be expanded if the incomplete integral of the Hamilton-Jacobi equation can be found that contains one free constant, and consequently describes an isoenergetic family of trajectories. The authors propose a method of constructing the incomplete integral from a known particular solution that satisfies a certain special condition. Motion of a material point of unit mass is considered in a two-dimensional field with potential $\Pi(x,y)$, where x and y are cartesian coordinates in the plane. The corresponding Hamilton-Jacobi equation is

$$1/2(S_x^2 + S_y^2) + \Pi(x,y) = h, \quad (1)$$

where $S(x, y, h, \alpha)$ is the complete integral, h is the total energy of the particle, and α is an arbitrary constant. A particular solution of (1) is found for some fixed energy value h_0 in the form $u(x, y)$, or an integral of the form $u(x, y, h)$ that satisfies the linear second-order homogeneous partial differential equation

$$u_{xx} + u_{yy} + au_x + bu_y = 0.$$

The method is illustrated by finding an analytical equation for the trajectories of dipole particles moving with zero total energy in an arbitrary two-dimensional harmonic electrostatic field. References 2 Russian. [2-6610]

USSR

UDC 620.171:621.642.3:311.16

INVESTIGATION OF THE CORRELATION BETWEEN MECHANICAL CHARACTERISTICS AND BREAKING STRESSES OF SPHERICAL PRESSURE VESSELS MADE FROM HIGH-STRENGTH MATERIALS

Kiev PROBLEMY PROCHNOSTI in Russian No 11(125), Nov 79 pp 38-41 manuscript received 18 Apr 78

KRAMAROV, M. A., RYBAKOV, A. B., DUDNIK, I. F. and VALASHOV, S. A., Leningrad, Dnepropetrovsk

[Abstract] One of the important technical problems of today is that of getting precise relations for calculating breaking stresses. To do this, research is needed in two areas: 1. statistical correlation analysis of test results on full-size vessels and mechanical tests of specimens to choose the laboratory criteria that best correlate with vessel strength, and also classification of vessels and materials with respect to a given criterion; 2. experimental and theoretical studies to get formulas for calculating the breaking stresses of vessels as a function of the magnitude of defects and the values of selected criteria. This paper deals with the first of these goals as applied to spherical pressure vessels made of VT14 titanium alloy. The vessels had an inside diameter of 400 mm and wall thickness of 7 mm with thickening of 9 mm in welds. Pressure tests were done with water loading at a rate of 110-140 atm/min. Fracture in all cases was initiated from internal flaws with a maximum size of no more than 2 mm in the base metal outside of welds. An investigation was made of the correlation between breaking stresses and the major properties of the material used for making the tanks. Breaking stresses showed the closest correlation with the coefficient of stress intensity as determined in static bending tests of a specimen with a fatigue crack. Figure 1; references 7: 6 Russian, 1 Western. [19-6610]

USSR

UDC 539.376

ON EVALUATING THE LIMITING LOAD-BEARING CAPACITY OF THIN-WALLED PIPES FROM THE INSTANT OF ONSET OF STRAIN LOCALIZATION

Kiev PROBLEMY PROCHNOSTI in Russian No 11(125), Nov 79 pp 55-57 manuscript received 19 Jul 78

YELSUF'YEV, S. A. and IZOTOV, I. N., Leningrad

[Abstract] In a previous paper [S. A. Yelsuf'yev, PROBLEMY PROCHNOSTI, 1978, No 4, pp 86-89] formulas were derived for the limiting load-bearing capacity of thin-walled pipes loaded by internal pressure and axial force under conditions of creep. In this paper, these same formulas are used to predict the time of onset of strain localization in pipes made of plastically deformable materials that do not show creep. Time is not a factor in the formulas derived by Yelsuf'yev for finding the limiting deformations of thin-walled pipes under creep conditions. Therefore it is valid to apply them to the case where the relations between stresses and strains can be considered independent of time. It is shown how these formulas are related to known criteria of stability of plastic deformation during bending. To describe the process of exhaustion of the limiting load-bearing capacity of low-ductility metals, the authors introduce the damageability parameter of creep destruction theory. A comparison of the theoretical predictions with the experimental data on fracture of pipes shows that the proposed technique gives a fairly accurate figure for the time of onset of strain localization of structural components in the compound stressed state. References 11: 8 Russian, 3 Western.
[19-6610]

USSR

UDC 539.4:629.7.023

PLASTIC FRACTURE OF COMPOSITE SHELL STRUCTURES UNDER AXIAL COMPRESSION

Kiev PROBLEMY PROCHNOSTI in Russian No 11(125), Nov 79 pp 58-61 manuscript received 13 Feb 78

GERASIMOV, V. P., GUDRAMOVICH, V. S., LARIONOV, I. F., MULYAR, YU. M. and SAVVIN, YU. I., Dnepropetrovsk Department of the Institute of Mechanics, Academy of Sciences UkrSSR

[Abstract] Based on analysis of the kinematically admissible field of displacement velocities, the authors determine the upper limit of the axial load for three types of shell structures: cylindrical and conical shells reinforced by a cross member, and butt-joined conical shells, and also a

thick-walled cylindrical shell with an annular dent. The idealized behavior of the system during destruction is described by the kinematic formation of plastic hinges. Specific experimental data for the destructive load of AMg6M alloy shells show good agreement with the theoretical calculations. Figures 4; references 4 Russian.
[19-6610]

USSR

UDC 537.3.013.43-539.3-531.133

THREE-DIMENSIONAL STRESSED STATE THAT ARISES IN THE VICINITY OF A RIB OF A THICK-WALLED COMPOSITE CYLINDER UNDER THE ACTION OF HYDRAULIC HAMMER

Kiev PROBLEMY PROCHNOSTI in Russian No 11(125), Nov 79 pp 62-66 manuscript received 3 May 79

BABICH, YU. N. and GALIYEV, SH. U., Kiev, Institute of Strength Problems Academy of Sciences UkrSSR

[Abstract] In studying the response of a structure to the action of an underwater wave, its behavior is usually described by equations of the theory of shells. While this approach is valid for thin-walled bodies, other cases require the use of equations of the dynamic theory of elasticity. In this paper, the authors develop algorithms for solving three-dimensional dynamic problems of elasticity theory for bodies of cylindrical shape, and give the solution for new problems of hydroelasticity. A stable finite-difference scheme is proposed for approximation of the boundary value problem. The method of least squares is used in a local coordinate system for calculating displacements at corner points. An investigation is made of the influence that the length of an underwater wave has on the stressed state that arises close to a rib in the initial instant of interaction between a cylinder and liquid. It is shown that a reduction in wavelength leads to the arising of zones of tensile stresses, and therefore short waves present a danger to structures made of brittle materials. Figures 4; references 12 Russian.
[19-6610]

OSCILLATIONS OF BELLOWS WITH CONSIDERATION OF ENERGY DISSIPATION IN THE MATERIAL

Kiev PROBLEMY PROCHNOSTI in Russian No 11(125), Nov 79 pp 67-71 manuscript received 24 Oct 78

KHIL'CHEVSKIY, V. V. and DUBENETS, V. G., Kiev Polytechnical Institute

[Abstract] The authors consider a shell of revolution that consists of equidistant parallel annular plates smoothly interconnected by parts of toroidal shells. It is assumed that the rounding radius of the corrugations of the bellows is small compared with the depth of the corrugations, and that the influence of this radius on the stressed and strained state of the shells can be disregarded. Under axisymmetric strain, there is a change in the distances between the extreme sections passing through the crests and valleys of the corrugations. The deformation of the bellows is comprised of the displacements of adjacent pairs of extreme sections. The part of the bellows situated between two adjacent sections can be treated as an annular plate with the inside edge securely clamped, and the outer edge unable to rotate during displacement. A dynamic analysis is made of oscillations of a typical periodically repeating element (annular plate) with corresponding conditions of fastening on the inner and outer radii. The Hamilton-Ostrogradskiy integral principle is used to derive equations for the oscillations with consideration of energy dissipation in the material. The problem is solved in the first approximation by the Frylov Bogolyubov method. Figure 1; references 7 Russian.
[19-6610]

OSCILLATIONS OF THIN-WALLED OPEN RODS MADE OF MATERIAL WITH NONLINEAR HYSTERESIS

Kiev PROBLEMY PROCHNOSTI in Russian No 11(125), Nov 79 pp 72-76 manuscript received 11 Jul 78

VASILENKO, N. V. and TRIVAYLO, P. M., Kiev Polytechnical Institute

[Abstract] The theory of thin-walled rods made of material that deforms in accordance with Hooke law has been thoroughly worked out. In this paper, the authors evaluate the effect of constrained twisting in the case where the material of a thin-walled rod does not conform to Hooke law, with the

same assumption of nondeformability of the cross section as made in the linear theory. A numerical example is given, assuming that the conditions of constrained twisting are satisfied by securing the ends of a rod shell and insertion of intermediate rigid diaphragms. These diaphragms also prevent loss of torsional stability. The stress values found are compared with the corresponding values given by the linear theory. It is shown that the nonlinear theory increases normal axial, bending and tangential sectoral stresses by 19, 2.4 and 27% respectively. Figures 2; references 2 Russian. [19-6610]

USSR

UDC 620.174:519.24:666.1

INVESTIGATION OF THE STRENGTH OF GLASS BY THE METHOD OF RADIAL COMPRESSION OF ANNULAR SPECIMENS

Kiev PROBLEMY PROCHNOSTI in Russian No 11(125), Nov 79 pp 80-83 manuscript received 14 Mar 79

POLESHKO, A. P. and SOLUYANOV, V. G., Kiev, Institute of Strength Problems, Academy of Sciences UkrSSR

[Abstract] The authors study the feasibility of using a method for determining the bending strength of glass by radial compression of annular specimens cut from pipes. Experimental strength values are compared with those of cast prismatic specimens tested in a pure bending arrangement. The annular specimens were cut from 13v glass pipes 45, 68 and 93 mm in diameter with wall thickness of 3.5, 4.0 and 5.0 mm respectively. The width of the annular specimens was 20 mm. The prismatic specimens were cut from annealed glass plates, and measured 4.5 x 6 x 60 mm, and 9 x 12 x 120 mm. All specimens were subsequently polished to a surface finish of class 9-10. The tests were done on the universal TsD-4 machine at a rate of stress increase of 0.3-0.4 kgf/mm²/s. The experimental data are statistically analyzed. The results show that the method of radial compression of rings is the simplest way to check the strength of pipes. Figures 3; references 6 Russian. [19-6610]

USSR

UDC 621.1+536

AN EXPERIMENTAL FACILITY FOR STUDYING THE THERMOPHYSICAL AND ELECTRICAL
PARAMETERS OF ROCKS IN THE TEMPERATURE RANGE OF 20-800°C IN A VACUUM

Tbilisi SOOBSHCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian Vol 96 No 1,
1979 pp 153-156 manuscript received 27 Jul 79

CHANISHVILI, Z. V., Institute of Geophysics, Academy of Sciences Georgian SSR

[Abstract] To study the structure and properties of the depths of the earth it is necessary to know the physical properties of rocks over a wide temperature range. The purpose of this research was to develop a facility for simultaneous measurement of both the thermophysical and electrical parameters of rocks at high temperatures in vacuum. The basis of the facility was a unit developed at the Institute of Physics of the Earth of Moscow State University for measuring thermal diffusivity, heat conduction and specific heat. This unit was updated to include measurements of capacitance and electrical conductivity. The measurements are made by a capacitance bridge through platinum electrodes in contact with areas of the specimen that are sputtered with platinum. The facility can also be used for determining the thermo-emf of hot rocks, and measurements can be made in an inert atmosphere as well as in vacuum. Figures 3; references 5 Russian.

[15-6610]

USSR

UDC 621.822.5:62-251-752

EFFECT THAT ERRORS IN SHAPE OF PIVOT AND BUSHING IN THE TRANSVERSE DIRECTION
HAVE ON THE TRAJECTORY OF MOTION OF A ROTOR

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 12, 1979 pp 19-21

KONDRATYUK, S. V. and SKVORTSOV, A. V.

[Abstract] The effect of off-design variations in the shape of the pivot and bushing of a journal bearing of an operating compressor rotor is analyzed. It is shown that in some cases the increments in the vibration amplitudes of the pivot center are several times as high as those determined in calculations based on a pivot and bushing of ideal shape. The smaller the bearing clearance the more exact the shape tolerances must be in order to reduce the vibration amplitudes of the rotor. The calculations also show that off-design variations exceeding 30-35 μm can result in fracture of the components. Hence, for new rotors and bearings the errors of shape should

not exceed 5-10 μm . A system of differential equations describing the motion of the pivot center under the action of the forces exerted on it by an operating rotor is presented. Figures 2; references 5 Russian. [20-1386]

USSR

UDC 621.039.66

A SMALL 5-CHANNEL ELECTROSTATIC ANALYZER OF AN ELECTRON ENERGY SPECTRUM

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 171-173 manuscript received 10 May 78

BEREZHETSKAYA, N. K. and DOROFYUK, A. A., Institute of Physics, USSR Academy of Sciences

[Abstract] A small electrostatic analyzer has been built for measurement of the electron energy spectrum in a pulsating plasma which disperses in vacuum from an initial concentration of 10^{13} cm^{-3} . It is capable of making a complete measurement during one plasma pulse, taking into account the non-Maxwellian tails of energy distribution of electrons and minimizing the signal due to plasma radiation. The electron flux passes through a collimator and then through a deflecting plane-parallel capacitor. Electrons moving now at five different angles to their original trajectory pass through holes in a grid plate, are then accelerated by a potential higher than 5-7 kV and thus much higher than their energy, and impinge on a polystyrene scintillator with five corresponding photomultipliers. The scintillator is coated with a thin aluminum film, for protection against scattered plasma radiation, and the entire assembly with the grid plate is inclined rather than normal to the diverging electron flux leaving the capacitor-deflector so as to avoid exposure to ultraviolet and X radiation. Signals from all photomultipliers pass through a wide band amplifier with 100% negative feedback, to ensure a time resolution of 0.1 μs , to a 5-beam oscilloscope. Figures 2; references 2: 1 Russian, 1 Western.
[31-2415]

USSR

UDC 539.1.074+621.317.31

AN ELECTRON DETECTOR WITH A TRAVELING WAVE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 173-175 manuscript received 24 Jul 78

GONCHAROV, A. S., KAZAKOV, V. M. and KOZLOV, O. V.

[Abstract] An electron detector with subnanosecond time resolution is described which measures the parameters of electron current pulses in guns and accelerators. It comprises a segment of a coaxial cylindrical line at one end connected through a matching transmission line to a wide band recording instrument and at the other end loaded by a matching resistance. Electrons

enter through a window in the lateral surface of the outer cylinder-electrode and are collected by the inner cylinder-electrode. The detector operates on the basis of the "traveling wave" principle. As electrons strike the window, two TEM waves begin to propagate axially through the interelectrode space in opposite directions: one toward the load resistance, where its energy will be absorbed, and one toward the recording instrument. With the impedances properly matched, there will be no reflections and no standing waves. The time resolution of this detector depends on the pulse rise time, the electron transit time, and the wave propagation time. With sufficiently small diameters of the two cylinders and at a sufficiently low residual gas pressure inside, electron current pulses will be recorded without shape distortions. Such a detector was built with the following dimensions: diameter of outer cylinder 63 mm, diameter of inner cylinder 18 mm, length 400 mm and width of window 5 mm. Its characteristic impedance was 75 Ω , the window was covered with a thin mylar film and the residual pressure was reduced to 10^{-3} torr. Figures 2; references 6: 4 Russian, 2 Western. [31-2415]

USSR

UDC 621.385.831

DEPENDENCE OF THE COUNT CHARACTERISTICS OF SECONDARY-ELECTRON MULTIPLIERS ON THE PRESSURE OF RESIDUAL GASES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 176-177 manuscript received 15 May 78

BARKOVSKIY, V. N., VYDRIK, A. A., KOROBKOV, I. N. and MIKUTSKIY, V. G., Experimental-Design Office for Engineering Cybernetics, Leningrad Polytechnic Institute

[Abstract] A study was made of VEU-1A,4,6 secondary-electron multipliers, for the purpose of determining the dependence of their count rate and of the background noise on the pressure of residual gases. With a beta-Sr⁹⁰ radiation source in the form of a disk at the inlet to the instrument and the latter inside a vacuum chamber, the count rate was measured at various discrimination threshold voltages as a function of the pressure from $5 \cdot 10^{-3}$ torr to levels below interdiode breakdown. The count rate was found to decrease monotonically in the case of the VEU-1A device (breakdown pressure 0.4 Pa), to peak within the 1.2-1.4 Pa range in the case of the VEU-4 device and to remain almost constant throughout in the case of the VEU-6 device. For noise measurements the radiation source was covered with a shield impermeable to electrons, but the noise level remained still high above the "dark" count rate without a source, probably due to ionization of the residual gas. The background noise was particularly high in the VEU-1A device, and increased rapidly with higher pressure. Figures 2; references 7 Russian, 6 Western. [31-2415]

USSR

UDC 681.26.089.6:531.787.2

MEASURING AERODYNAMIC FORCES AND MOMENTS WITH A STRAIN-GAGE BALANCE

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 79 pp 53-55

LEVITSKIY, N. P., KHRAMOVA, M. A., POSTNOV, A. I. and ZIMENKOV, V. I.
(deceased)

[Abstract] Strain-gage balances are widely used for aerodynamic testing of aircraft models. Such balances constitute an elastic system which takes up and balances forces and moments acting on the model. The elements of this system for measuring respectively the X,Y,Z components of forces and moments in statically indeterminate system are most conveniently mounted inside the model. They are connected in electrical bridge circuits which generate appropriate voltage signals. Each element must be designed to have the necessary sensitivity to whatever force or moment component it measures, to have an adequate fatigue resistance under worst conditions, and to have a natural frequency when mounted in the model which differs sufficiently from the frequency of periodic forces or moments it measures. The transducer characteristics of such balances are determined from experimental data and from matrix equations solvable with the aid of a computer. Figures 6; references 3 Russian.
[28-2415]

USSR

UDC 621.083.8.082.73.089.5

MEASURING AND CHECKING THE SENSITIVITY OF PIEZOELECTRIC TRANSDUCERS AT LOW FREQUENCIES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 79 pp 68-69

PAVLOV, L. YE. and SIL'VESTROV, S. V.

[Abstract] The sensitivity of a piezoelectric transducer in a hydroacoustic system at frequencies below one third of its first resonance frequency can be checked by measurement with a voltmeter whose readings are proportional to the input impedance. This is demonstrated here in the case of a spherical transducer with a high leakage impedance, a force factor independent of the frequency in this range, a diffraction coefficient near unity, and an acoustic compliance that does not change due to accretion in service. The relations are based on the equivalent circuit diagram and have been verified experimentally. The amplitude-frequency responses of two such transducers, one 40 mm and one 20 mm in diameter, were measured over the $0.5-10^4$ Hz range

as well as independently, for comparison, by the piezo-compensation method in a small chamber at frequencies from 1 to 4000 Hz and by the reciprocity method in a tank at higher frequencies. With the sensitivity tied to absolute values at 0.6 Hz on the basis of variable depth, the variation of absolute sensitivity over the 10^2 - 10^3 Hz range was determined from capacitance measurements before and after partial depolarization and coating with a thin epoxy film. Measurements and calculations agreed within 0.8 dB. Figures 3; references 4 Russian.
[28-2415]

USSR

UDC 534.321.9.08

A TUNABLE AUTOMATIC ACOUSTIC BRIDGE

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 79 pp 69-70

MASALITIN, YE. A., FIL', V. D. and GORBORUKOV, P. M.

[Abstract] A tunable automatic acoustic bridge is proposed for simultaneous measurement of changes in the absorption and in the velocity of ultrasonic waves propagating through a medium. It provides continuous tuning over a wide frequency range with a high phase stability and high accuracy even under conditions of strong damping. Two high-frequency diode switches with an attenuator and the test specimen form an acoustic pulse bridge circuit with amplitude regulation by means of the attenuator and phase regulation by means of an oscillator. Also included are a frequency meter, a pulse keyer, an error signal amplifier, a reference signal amplifier, two synchronous detectors, a heterodyne, two servos, and an automatic heterodyne frequency trimmer for compensating phase shifts in an intermediate-frequency amplifier. Manual or automatic gain control ensures steady sensitivity during the time of absorption measurements. Self-excitation of the system is avoided and high accuracy of measurements at high gain levels is thus ensured by correcting with respect to the derivatives of error signals through tachometer-generators coupled to the servo motors. Figures 2; references 2 Russian.
[28-2415]

BELLOWS STRAIN-GAGE PRESSURE TRANSDUCERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 12, Dec 79 pp 42-43

TASHKINOV, G. D., SOROKIN, V. A. and TIKHONOVA, L. V.

[Abstract] Type PTS strain-gage bellows pressure transducers are widely used for absolute and relative pressure measurements since they are more sensitive than diaphragm-type transducers. The construction of the device is shown in the diagram. The pressure to be measured enters through nipple 11 and is sensed by bellows 8. One face of the bellows is fastened to the housing, and the other face is connected to disk 3. The disk is secured by bolt 7 to the beam of elastic element 4 to which four strain-gage resistors 5 are cemented. The housing, the elastic element and cover 6, with sealing gaskets 9 between them, are drawn together by four bolts 2. Reference pressure coming through nipple 1 acts on the transducer housing. The pressure difference is converted to a change in resistances of the strain-gages, which are connected in a bridge circuit. The beam with elastic element made of steel is connected by four tie plates that act as hinges. Curves are given showing beam thickness as a function of pressure, beam deflection as a function of pressure, and the ratio between the torque sensed in the tie plates to the torque in the middle of the beam as a function of thickness. Figures 2.

[16-6610]

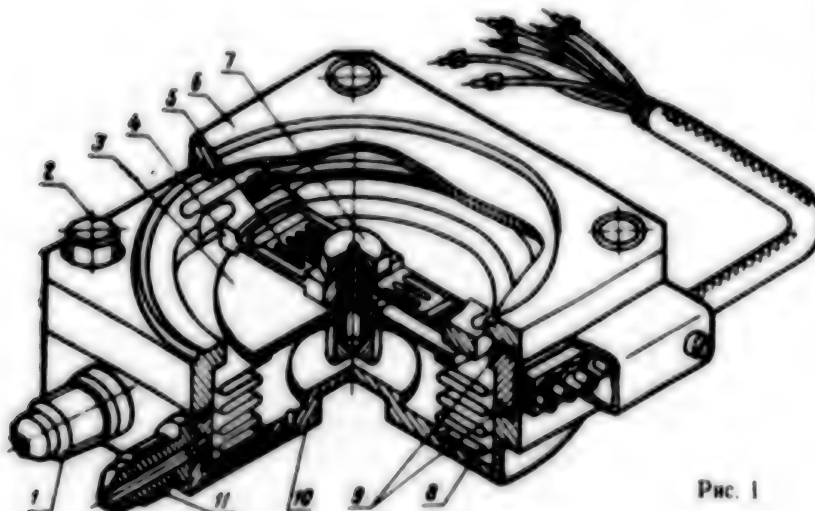


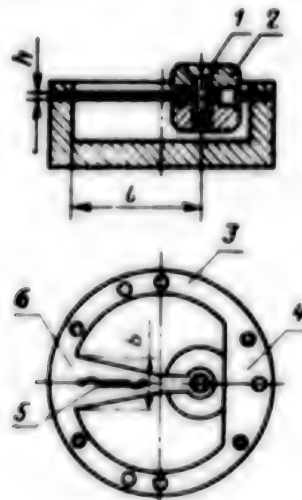
Рис. 1

STRAIN-GAGE ACCELEROMETERS WITH PROTECTION FROM G-FORCES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 12, Dec 79 pp 43-44

MOSKALIK, L. M.

[Abstract] The use of semiconductor strain gages in accelerometers improves sensitivity and reduces overall dimensions and mass, but such accelerometers may not be as stable as other types unless special steps are taken to protect against impact shocks. The diagram shows the construction of the V-8 accelerometer with limiters of the motion of the elastic element 3 made in the form of an annular plate fastened to the housing around the perimeter with two extensions 4 and 6. Fastened to both sides of extension 6 are silicon strain gages 5 connected in a bridge circuit with two active arms, and weight 2 made of two parts held together by screw 1. Projection 4 fits in the gap between the two parts of this weight. Technical specifications are given for three modifications of this design. Figure 1; references 6 Russian. [16-6610]



USSR

UDC 621.382.029.64

VOLUMETRIC INTERACTION OF FERRITE AND CERAMIC IN COMBINED HOT PRESSING

Moscow IZVESTIYA VUZov: MASHINOSTROYENIYE in Russian No 12, 1979 pp 92-95
manuscript received 21 Feb 78

ROGDANOVA, L. N., candidate of technical sciences

[Abstract] Methods of microstructural, microscopic x-ray spectral and x-ray phase analysis are used to study the transition zone that arises in hot pressing of ferrite-ceramic composite. It was found that composites hot-pressed from ferrite containing 47.74% Fe_2O_3 , 47.1% V_2O_3 , 0.2% MnO and 4.96% Al_2O_3 , and ceramic containing 99.9% MgO and 0.1% V_2O_5 have a definite transition zone of mutual solubility. Calculation of the activation energy of formation of the transition layer of this composite gives a value of 57.3 kcal/mole at temperatures up to 1523 K and 39.3 kcal/mole at higher temperatures. In the zone of composite formation the reaction product is MgV_2O_4 . The instant of formation of the ferrite-ceramic system is accompanied by compaction of the materials and mutual diffusion of the components, which lasts for two minutes of holding under a load, after which there is a reduction in the rate of both processes. Figures 3; references 3 Russian.
[3-6610]

USSR

UDC 669.3.071

TRANSVERSE-HELICAL ROLLING OF CHROMIUM-ZIRCONIUM BRONZE

Moscow IZVESTIYA VUZov: MASHINOSTROYENIYE in Russian No 12, 1979 pp 96-99
manuscript received 20 Dec 78

ARUTYUNOVA, I. F., graduate student, BEREZHNOY, V. V., candidate of technical sciences, KORNEYEVA, I. M., engineer, MUKHIN, G. G., candidate of technical sciences, docent, and SINEL'NIKOV, S. I., engineer

[Abstract] It has been found that sputtering molten zirconium and chromium-zirconium bronzes to produce powder results in formation of a two-phase structure in the powder particles. The second phase forms an unbroken three-dimensional grid. In this paper the authors investigate the applicability of transverse-helical rolling for hot reduction of sintered chromium-zirconium bronze. A three-high mill with periodic action was used. The grooving angle was 20° , and the diameter of the grooved section was 10 mm. The stock was heated at 820-860°C for 15 minutes before rolling. Rolling

was started within 7-10 s after the material was removed from the furnace. The feed angle was 6°. Tests showed satisfactory mechanical properties of the rolled bronze. This is attributed to uniform distribution of fine particles of the second phase throughout the material and dissociation of the supersaturated solid solution during heating and rolling. This is confirmed by metallographic analysis. Figure 1, references 6: 5 Russian, 1 Western. [3-6610]

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